

layers of a semiconducting material that alternate with the sheets of the first material and that may be ionized by the second particles, each of the layers being associated with one of the sheets, the stack having opposite first and second faces each including corresponding edges of the sheets and layers, the detector configured to be laid out such that the ionizing radiation arrives on the first face, a length of each sheet measured from the first face as far as the second face being equal to at least one tenth of a free average path of the first particles in the first material;

groups of parallel and electrically conducting tracks extending from the first face to the second face parallel to the layers, each group being associated with one of the layers and in contact with an associated layer, the tracks being designed to collect charge carriers that are generated in the layers by interaction of the layers with at least one of the second particles and the first particles and that are representative of the first particles in intensity and in position; and

means for creating an electric field capable of causing collection of charge carriers through the tracks.

13. (New) Detector according to claim 12, wherein the first material is electrically conducting, the tracks are electrically insulated from the sheets, and the means for creating the electric field comprises means for applying a voltage between the tracks and the sheets, this voltage able to cause the collection of charge carriers through the tracks.

14. (New) Detector according to claim 12, wherein each group of tracks is fully located within the layer with which it is associated.

15. (New) Detector according to claim 14, wherein the first material is electrically conducting and the means for creating the electric field comprises means for applying a

voltage between the tracks and the sheets, this voltage able to cause the collection of charge carriers through the tracks.

16. (New) Detector according to claim 12, wherein the sheets are electrically insulating, an electrically conducting layer is inserted between each layer of semiconducting material and the sheet that is associated with it, and the means for creating the electric field comprises means for applying a voltage between the tracks and the electrically conducting layers, this voltage able to cause the collection of charge carriers through the tracks.

17. (New) Detector according to claim 12, wherein the semiconducting material is selected from the group consisting of thin layers of diamond, CdTe, ZnTe, CdZnTe, AsGa and their alloys, InP, InSb, SiC, crystalline silicon, amorphous silicon, organic crystals, amorphous selenium, and chalcogenic glass ( $\text{As}_2\text{S}_3$ ).

18. (New) Detector according to claim 12, further comprising an electronic device configured to read electrical signals output by tracks when the tracks collect charge carriers.

19. (New) Detector according to claim 18, wherein one end of each track is curved to extend onto an edge of the corresponding layer of semiconducting material, this edge being located on the second face of the stack, and further comprising electrically conducting pads that are in contact with the corresponding curved ends of the tracks.

20. (New) Process for manufacturing the detector according to claim 12, wherein a layer of semiconducting material is formed on each sheet, this layer being provided with the group of tracks associated with it, and the sheets provided with layers of semiconducting material and tracks are assembled together to obtain a stack in which these layers of semiconducting material alternate with the sheets.

21. (New) Process according to claim 20, wherein a first layer of semiconducting material is formed on each sheet, a thickness being less than a thickness of the layer of